

CURRICULUM VITAE ABREVIADO (CVA)

IMPORTANT – The Curriculum Vitae cannot exceed 4 pages. Instructions to fill this document are available in the website.

Part A. PERSONAL INFORMATION

First name	Miguel		
Family name	Carvajal Zaera		
Gender (*)		Birth date (dd/mm/yyyy)	
Social Security, Passport, ID number			
e-mail		URL Web https://www.uhu.es/fmc/member/4	
Open Researcher and Contributor ID (ORCID) (*)		L-2756-2014 0000-0001-8743-129X	

(*) Mandatory

A.1. Current position

Position	Catedrático de Universidad (Full Professor)		
Initial date	12/06/2023		
Institution	Universidad de Huelva		
Department/Center	Dpto. Ciencias Integradas	Facultad de CC. Experimentales; Centro de Estudios Avanzados de Física, Matemáticas y Computación	
Country	Spain	Teleph. number	
Key words	Algebraic models in molecular structure, non-rigid molecules, vibration-rotation, infrared, microwave, astrophysical and atmospherical molecules, interstellar medium		

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
Jul. 2009 – Jun. 2023	Associate Professor/University of Huelva
Nov. 2006 – Jul. 2009	Lecturer(Profesor Contratado Doctor)/University of Huelva

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Degree in Physics	Universidad de Sevilla	1996
PhD in Physics	Universidad de Sevilla	2001

(Include all the necessary rows)

Part B. CV SUMMARY (max. 5000 characters, including spaces)

Prof. Carvajal is expert in the field of Molecular Physics and Chemical Physics and is involved in four main research lines: 1.- Development of algebraic approaches for the study of the molecular rovibrational structure; 2.- Spectral analysis and detection of astrophysical and atmospheric non-rigid molecules in the millimeter and microwave ranges; 3.- Spectral characterisation of non-rigid molecules based on ab initio calculations; and 4.- Study of the influence of the Excited States Quantum Phase Transitions in the spectral properties of collective many-body quantum systems, e.g., for the isomerization processes in molecules, Lipkin-Meshkov-Glick model, etc. He has developed many different theoretical approaches stemmed from his experience acquired during the research stays and positions in different prestigious research centers: Seville Univ., Inst. de Ciencias Nucleares (UNAM, Mexico), Bergische Universität -Wuppertal, Université Paris-Sud, Université Lille I, Laboratoire

Interuniversitaire de Systèmes Atmosphériques (CNRS, Paris) and University College of London (UK), among others.

To date, he has published 80 works in JCR journals, 3 chapters in scientific books and contributed with 107 presentations in Conferences (18 since 2021: 4 invited, 11 oral communications and 3 posters). In addition, he has contributed on the publication on the web of the software “The BELGian Internal Rotor Program” for the rovibrational transitions calculation and assignment of molecules with a internal rotor (<http://www.ifpan.edu.pl/~kisiel/introt/introt.htm>) and the spectral lines of $\text{H}^{13}\text{COOCH}_3$ in the databases for astrophysical applications: SPLATALOG (<https://splatalogue.online/>) and CDMS (<https://cdms.astro.uni-koeln.de/>).

He participates or has participated in 37 funded research projects: 5 by the European Union, 3 COST Actions (one of them as Management Committee Substitute of COST Action CM1405 “Molecules in Motion”), 6 by the Spanish Government, 6 from ERDF funding, 1 by the Mexican Government, ... As leader, he has been main researcher of two ERDF research projects, the Spanish Government project PID2019-104002GB-C21 (2020-2022), main researcher at the Univ. of Huelva and Work Package coordinator of the European EIT HEI Initiative HEI4S3-RM and, at present, he is main researcher at the Univ. of Huelva and Work Package coordinator of the European Research Project H2020-MSCA-RISE-2019 ATMOS and the Responsible of Work Package 5 in Univ. Of Huelva at the European Universities Alliance PIONEER as well as coordinator at the Univ. of Huelva of the Research Unit GIFMAN-UHU Associated to CSIC (since 2016).

He has been co-chair and member of the Scientific Organizing Committee of the international conference “Anharmonicity in medium-sized molecules and clusters (AMOC2015)” (Madrid, 2015), chair of “I Workshop on nonrigid molecules in atmospherical and astronomical environments” (Huelva, 2019), member of the Scientific Committee of “International Winter School on Atmospheric Chemistry, Greenhouse gases and Pollutants” (Rabat, 2022), member of the Organizing Committee of “ATMOS 2023, Greenhouse gases and pollutants. Spectroscopy, reactivity and gas-gas and gas-solid interactions: Theoretical and experimental techniques” (Madrid, 2023) and of the the Scientific Committee of the conference “ATMOS 2025, Greenhouse gases and pollutants. Spectroscopy, reactivity and gas-gas and gas-solid interactions: Theoretical and experimental techniques” (Agadir, 2025).

He collaborates with many international scientists (around 87% of his publications are with international collaborators of 90 different institutions). These collaborations have fostered the molecular identification in interstellar clouds and the involvement in 8 proposals for observational time in radiotelescopes such as IRAM, ONSALA/APEX, ALMA and NOEMA and in a proposal for an experiment in AILES Beamline (SOLEIL Synchrotron).

In the training, he has supervised two PhD (Jamil Khalouf-Rivera, 2022; Oko Godwin, 2026) and 13 master theses (one in 2007, one in 2021, five in 2022, 4 in 2023 and 2 in 2025) as well as he is or has been supervisor of long postdocs research stays (10 times) and of foreigner PhD students (5 times). Nowadays, since 2022, he is supervising the PhD of Mr. Amine Rafik and it will be defended on June 2026.

In the Univ. of Huelva, Prof. Carvajal has been promoted six times via external tender before being full professor in June 2023 and has been Secretary of Department from 2014 to 2017. Since 2017 up to now, he is Director of International Research Projects on the Vice-rectorate of Research and Knowledge Transfer.

To finish with, he is associate Member of the Instituto Universitario de Investigación “Carlos I” de Física Teórica y Computacional, reviewer of JCR journals (J. Chem. Phys., Astron.&Astrophys, J. Phys. Chem. A, ...), Guest Editor of Journal of Physical Chemistry A, Special Issue “Spectroscopy and Dynamics of Medium-Sized Molecules and Clusters: Theory, Experiment and Applications” (Vol. 120, Issue 4, pp. 475-656, 2016) and is involved in dissemination activities such as the participation in the EU Researchers Night (since 2018) and contributed in press releases and research interviews in local media.

Other information relevant:

Four six-year periods of research awarded by the CNEAI (last one: 2017-2022)

Total number of papers in ORCID: 85 (80 in WoS)

Papers in press: 3

% WoS documents (47.83% in Q1 journals; 33.33% in Q2; and 18.84% in Q3) (Source: InCites dataset)

Numbers of papers in first tercile (T1): 43

Sum of times cited (WoS): 1563

H-index (WoS): 23

Supervision of 3 PhD students: Jamil Khalouf-Rivera, 2022; Oko Godwin, 2026; Amine Rafik, to be defended on June 2026.

Part C. RELEVANT MERITS (sorted by typology)

C.1. Publications (see instructions)

Five of the publications from the last five years: **(1)** D.R. Campanha, E. Mendoza, M.X. Silva, P.F.G. Velloso, M. Carvajal, V. Wakelam, B.R.L. Galvão, "The Si + SO₂ collision and an extended network of neutral-neutral reactions between silicon and sulphur bearing species", Monthly Notices of the Royal Astronomical Society, 515 (2022) 369-377. **(2)** C.M. Canelo, L. Bronfman, E. Mendoza, N. Duronea, M. Merello, M. Carvajal, A.C.S. Friaca, and J. Lepine, "Isocyanic acid (HNCO) in the Hot Molecular Core G331.512-0.103: Observations and Chemical Modelling", Monthly Notices of the Royal Astronomical Society, 504 (2021) 4428-4444. **(3)** J.M. Fernández, G. Tejeda, M. Carvajal and M.L. Senent, "New spectral characterization of dimethyl ether isotopologues CH₃OCH₃ and (13)CH₃OCH₃ in the THz region", The Astrophysical Journal Supplement Series, 241 (2019) 13 (9 pp.). **(4)** M. Carvajal, C. Favre, I. Kleiner, C. Ceccarelli, E.A. Bergin and D. Fedele, "Impact of nonconvergence and various approximations of the partition function on the molecular column densities in the interstellar medium", Astronomy & Astrophysics, 627 (2019) A65 (20 pp.). **(5)** J. Khalouf-Rivera, M. Carvajal, L.F. Santos and F. Pérez-Bernal, "Calculation of transition state energies in the HCN-HNC isomerization with an algebraic model", J. Phys. Chem. A, A123 (2019) 9544.

C.2. Congress, indicating the modality of their participation (invited conference, oral presentation, poster)

Five of the participations from the last five years: **(1)** M. Carvajal, "Algebraic approach for the spectral characterization of atmospheric molecules", ATMOS 2023, Greenhouse gases and pollutants. Spectroscopy, reactivity and gas-gas and gas-solid interactions: Theoretical and experimental techniques, CSIC, Madrid (Spain). Editor: IEM-CSIC (2023), pp. 25. Oral presentation. **(2)** M. Carvajal, "Molecular Symmetry", International Winter School on Atmospheric Chemistry, Greenhouse gases and Pollutants, Rabat, Morocco. Editor: Faculté des Sciences, Université Mohammed V (2022), pp. 25. Invited conference. **(3)** M. Carvajal, J. Khalouf-Rivera, F. Pérez-Bernal, and R. Lemus, "Global rovibrational analysis for the 20 lowest vibrational bands of hydrogen sulfide (H₂(32)S)", International Symposium on Molecular Spectroscopy, Urbana-Champaign, USA. Editor: University of Illinois (2021), pp. 158. Oral presentation. **(4)** M. Carvajal, M. Bermúdez-Montaña, R. Lemus, and F. Pérez-Bernal, "Accurate CO₂ Raman spectral simulation: an algebraic alternative based on anharmonic ladder operators", The 25th International Conference on High Resolution Molecular Spectroscopy (2018), Bilbao, Spain. Editor: Universidad del País Vasco (2018), Bilbao, pp. 108. Oral presentation. **(5)** M. Carvajal, M. Bermúdez-Montaña, R. Lemus, and F. Pérez-Bernal, "Spectral analysis approach based on anharmonic ladder operators", 3rd General Meeting of CM1405 COST Action - MOLIM: Molecules In Motion (2018), Budapest, Hungary. Editor: CM1405 COST Action, Budapest, Hungary, pp. 53. Invited Conference.

C.3. Research projects, indicating your personal contribution. In the case of young researchers, indicate lines of research for which they have been responsible.

(1) European Project H2020-MSCA-RISE-2019 (Ref. 872081) "Pollutants and greenhouse gases in the atmosphere - understanding gas-gas and gas-solid interactions towards a cleaner atmosphere (ATMOS)" (April 1, 2020 – January 31, 2026). Coordinator: Maria Luisa Senent Díez (CSIC). **UHU and WP Leader: Miguel Carvajal Zaera.** Funding: 892,400.00

Euros. Web page: <http://tct1.iem.csic.es/ATMOS.htm> **(2)** European Universities Alliance PIONEER . Coordinator: Gustave Eiffel University. **Responsible of WP5 in UHU: Miguel Carvajal Zaera.** Web page: <https://pioneer-alliance.eu/> **(3)** European Project "Building Ecosystem Integration Labs at HEI to foster Smart Specialization and Innovation on Sustainable Raw Materials (HEI4S3-RM)" funded by EIT HEI Initiative (2022-2024). Coordinator: Begoña Cueto Iglesias (Univ. Oviedo). **UHU and WP Leaders: Miguel Carvajal Zaera** and Reyes Sánchez Herrera. Funding: 1,200,000.00 €. **(4)** Research project no. PID2022-136228NB-C21 "Estudio de transiciones de fase cuánticas de estados excitados en sistemas con aplicación en computación cuántica" (2023-2025) supported by the Ministerio de Ciencia y Tecnología of Spain. Univ. Huelva. Funding: 56,250 Euros. Main Researchers: J.E. García Ramos and Francisco Pérez Bernal. **(5)** Research project no. PID2019-104002GB-C21 "Coexistencia de forma en el núcleo atómico" (2020-2022) supported by the Ministerio de Ciencia y Tecnología of Spain. Univ. Huelva. Funding: 36,300 Euros. **Main Researchers:** J.E. García Ramos and **Miguel Carvajal Zaera.** **(6)** COST Action CA21101 "Confined Molecular Systems: From a new generation of materials to the stars (COSY)" (September 27, 2022 – September 26, 2026) supported by the European Union. CSIC, University of Helsinki, Nicolaus Copernicus University, Technology and Metallurgy - National Institute of the Republic of Serbia, Consiglio Nazionale delle Ricerche (CNR, Italy), Aarhus University, Univ. Huelva, ... Coordinator: M. Pilar De Lara-Castells. **(7)** Research project no. PY2000764 "Astrofísica y Estructura Cuántica de la Materia" funded by the Junta de Andalucía (2021-2022). Funding: 40,000.00 Euros. Main Researcher: Ángel Miguel Sánchez Benítez. **(8)** European Project H2020-MSCA-NIGHT-2020 (Ref. 101036081) "OpenResearchers2021" (2021). Coordinator: Fundación Descubre. Funding: 154,102.82 Euros. UHU Leader: José Rodríguez Quintero. **(9)** Research Project IE17-5380-UHU "Adecuación del Equipamiento del Centro de Investigación CEAFCM" supported by the Junta de Andalucía (2020-2021). Coordinator: Ángel Miguel Sánchez Benítez. **(10)** Research Project no. UHU-1259772 "Contaminantes atmosféricos y gases de efecto invernadero" (January 1 – December 31, 2020) supported by The European Regional Development Fund (ERDF) in Andalusia. Universidad de Huelva (Spain). Funding: 13,200 Euros. **Main Researcher: Miguel Carvajal Zaera.** **(11)** Project no. EIN2019-103072 "Contaminantes y gases de efecto invernadero en la atmósfera. Estudio de las interacciones gas-gas y gas-sólido para una atmósfera más limpia" (2019-2020) supported by the Ministerio de Ciencia, Innovación y Universidades of Spain. Associate CSIC Unit Instituto Estructura de la Materia (CSIC)-Universidad de Huelva. Main Researcher: María Luisa Senent Díez. **(12)** Project no. EQC2018-004395-P "Equipamiento básico para el Laboratorio de Interacciones Fundamentales (LIFE) del CEAFCM-UHU" (2019-2019) supported by the Ministerio de Economía y Competitividad of Spain. Centro de Estudios Avanzados de Física, Matemáticas y Computación, Universidad de Huelva. Main Researcher: Ángel M. Sánchez Benítez. **(13)** COST Action CM1405 "Molecules in Motion" (MOLIM) (March 20, 2015 - March 19, 2019) supported by the European Union. Univ. Helsinki, CNRS, Eötvös Loránd Univ., CSIC, Univ. Huelva, Univ. College of London,... Coordinator: A. Csaszar. **MC Substitute of Management Committee: Miguel Carvajal Zaera.** **(14)** COST Action CM1401 "Our Astro-Chemical History" (March 20, 2015 – March 19, 2019) supported by the European Union. Univ. Grenoble-Alpes, LERMA, Max Planck Institute, Univ. Copenhagen, CSIC, IRAP, Univ. Huelva, CNRS, ... Coordinator: L. Wiesenfeld. **(15)** Research Project no. SOMM17-6105-UGR "Instituto Carlos I de Física Teórica y Computacional" (March 20, 2019 – December 31, 2020) supported by Andalusian Government. Funding: 341,555.00 Euros. Coordinator: E. Romera **(16)** Research project no. COOPB20364 "Theoretical study of the spectroscopy and reactivity of neutral organic species and organic radicals of astrophysical and atmospheric interest" (April 1, 2019 – December 31, 2020) supported by CSIC, Ministerio de Ciencia, Innovación y Universidades, Spanish Government. CSIC-Univ. Huelva-Univ. Mohammed V, Univ. el Manar, Univ. Manaouba. Funding: 24,000.00 Euros. Coordinator: M.L. Senent Díez. **(17)** Research project no. FIS2014-53448-C2-2-P "Fenómenos críticos en estructura molecular y nuclear. Análisis de especies moleculares de interés astrofísico" (2015-2018) supported by the Ministerio de Economía y Competitividad of Spain. Univ. Huelva. Funding: 43,560.00 Euros. Main researcher: F. Pérez Bernal. **(18)** Project no. UNHU15-CE-2848 "Equipamiento de cálculo científico de alto rendimiento @UHU" (2016-2018) supported by the Ministerio de Economía y Competitividad of Spain. Univ. Huelva. Funding: 165,310 Euros. Main Researcher: J.E. García Ramos